Name:_____ Date:_____

1. Determine an equation of the circle with centre $(3, -2)$ and radius 4

A. $(x-3)^2+(y+2)^2=4$
B. $(x+3)^2+(y-2)^2=4$
C. $(x+3)^2+(y-2)^2=16$
D. $(x-3)^2+(y+2)^2=16$

2. Find the midpoint of the line segment joining $P(-8, 4)$ and $Q(12, -20)$.

A. $(-10, 12)$
B. $(-2, 8)$
C. $(2, -8)$
D. $(10, -12)$

3. Which conic is represented by the equation $4x^2-4y^2+8x-24y-9=0$?

A. circle
B. ellipse
C. parabola
D. hyperbola

What is the domain of the relation $(x-1)^2+(y+3)^2=25$?

A. $-4 \le x \le 6$
B. $-6 \le x \le 4$
C. $-24 \le x \le 26$
D. $-26 \le x \le 24$

Which conic is described by the equation $4x^2+4y^2-x+y=0$?

A circle
B. ellipse
C. parabola
D. hyperbola

Determine an equation of a rectangular hyperbola with centre at $(-2, 0)$ and one vertex at $(4, 0)$.

A. $(x-2)^2-y^2=16$
B. $(x+2)^2-y^2=16$
C. $(x-2)^2-y^2=36$
D. $(x+2)^2-y^2=36$

What is the length of the minor axis of the ellipse $\frac{x^2}{9}+\frac{y^2}{16}=1$?

A. 3
B. 4
C. 6
D. 8

Determine the value of k $(k>0)$ so that the conjugate axis of the hyperbola $x^2-\frac{y^2}{k}=1$ is 2 units longer than the minor axis of the ellipse $\frac{x^2}{16}+\frac{y^2}{9}=1$.

A. 8
B. 10
C. 16
D. 25

Change the following equation to standard form.

$$2x^2+y^2-12x-10=0$$

A. $\frac{(x+3)^2}{4}+\frac{y^2}{8}=1$

B. $\frac{(x-3)^2}{4}+\frac{y^2}{8}=1$

C. $\frac{(x+3)^2}{14}+\frac{y^2}{28}=1$

D. $\frac{(x-3)^2}{14}+\frac{y^2}{28}=1$

Write $9x^2+y^2+36x-9=0$ in standard form.

A. $\frac{(x+2)^2}{\frac{13}{9}}+\frac{y^2}{13}=1$

B. $\frac{(x+2)^2}{3}+\frac{y^2}{27}=1$

C. $\frac{(x+2)^2}{5}+\frac{y^2}{45}=1$

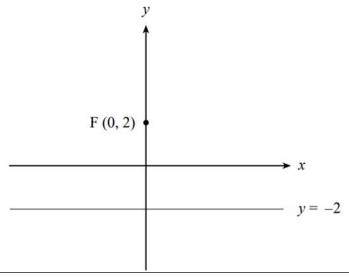
D. $\frac{(x+2)^2}{9}+\frac{y^2}{27}=1$

A point P moves such that it is always equidistant from the point $F(2, 5)$ and the line given by $y=1$. Find an equation of this locus and write it in standard form. **(3 marks)**

Determine the vertices of $\frac{(x+2)^2}{4}-\frac{(y-1)^2}{9}=-1$.

A. $(-2, -2)$ and $(-2, 4)$
B. $(0, 1)$ and $(-4, 1)$
C. $(0, -1)$ and $(4, -1)$
D. $(2, 2)$ and $(2, 4)$

A point P (x, y) moves such that it is always the same distance from the point F $(0, 2)$ as it is from the line defined by $y = -2$. Identify the locus.



Determine all values for r $(r > 0)$ such that the following system has **exactly** 2 different real solutions:

$$\frac{x^2}{9} + \frac{y^2}{4} = 1$$

$$x^2 + y^2 = r^2$$

A. $r = 2$
B. $r < 2$
C. $r = 2$ or $r = 3$
D. $2 < r < 3$

Determine the equation of the ellipse with vertices of $(3, 6)$ and $(3, -4)$ and minor axis of length 6.

A. $\frac{(x-3)^2}{9} + \frac{(y-1)^2}{25} = 1$
B. $\frac{(x+3)^2}{9} + \frac{(y+1)^2}{25} = 1$
C. $\frac{(x-3)^2}{25} + \frac{(y-1)^2}{9} = 1$
D. $\frac{(x+3)^2}{25} + \frac{(y+1)^2}{9} = 1$

Find all real solutions for the following system.

$$x^2 + y = 4$$

$$x^2 - y^2 = 4$$

A. $(-2, 0), (2, 0)$
B. $(-\sqrt{5}, -1), (\sqrt{5}, -1)$
C. $(-\sqrt{5}, 1), (\sqrt{5}, 1), (-2, 0), (2, 0)$
D. $(-\sqrt{5}, -1), (\sqrt{5}, -1), (-2, 0), (2, 0)$

Determine the area of the rectangle formed by the horizontal and vertical tangents to the conic $\frac{(x-1)^2}{9} + \frac{(y+2)^2}{16} = 1$.

A. 12 square units
B. 24 square units
C. 48 square units
D. 144 square units

Determine the vertex of the parabola given by the equation $4x - 8 = y^2 + 4y$.

A. (–1, 2)
B. (5, 2)
C. (1, –2)
D. (0, –4)

A point $P(x, y)$ moves such that it is always equidistant from the point $F(3, 2)$ and the line $y = -1$. Which equation represents this locus?

A. $(x-3)^2 + (y-2)^2 = (y+1)^2$
B. $(x-3)^2 + (y-2)^2 = (x+1)^2$
C. $(x+3)^2 + (y+2)^2 = (y-1)^2$
D. $(x+3)^2 + (y+2)^2 = (x-1)^2$

A point P moves such that it is always equidistant from 2 fixed points. Identify the locus.

A. line
B. circle
C. ellipse
D. parabola

A rectangular hyperbola with centre (2, 1) has one vertex at (2, 7). What is its equation?

A. $\frac{(x-2)^2}{36} - \frac{(y-1)^2}{36} = 1$
B. $\frac{(x-2)^2}{36} - \frac{(y-1)^2}{36} = -1$
C. $\frac{(x-2)^2}{49} - \frac{(y-1)^2}{49} = 1$
D. $\frac{(x-2)^2}{49} - \frac{(y-1)^2}{49} = -1$

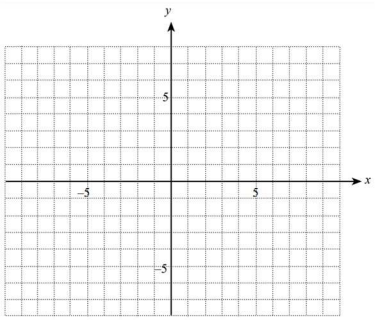
Which of the following values for the constants A and B will cause the equation $Axy + B = 0$ to represent a rectangular hyperbola with vertices on the line $y = -x$?

A. $A > 0, B < 0$
B. $A > 0, B > 0$
C. $A < 0, B > 0$
D. $A = 0, B < 0$

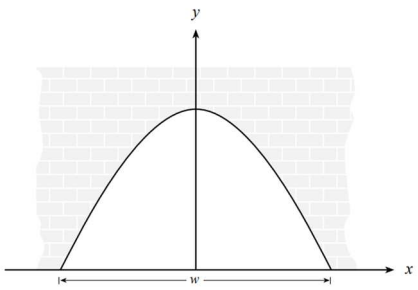
Graph the following system of inequalities:

$$(x - 3)^2 + y^2 > 36$$

$$x^2 - y^2 \leq 9$$



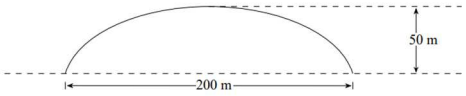
A parabolic arch supports a bridge over a canal, as shown in the diagram. If an equation of the arch is $y = -\frac{1}{30}x^2 + 5$, determine the width w of the canal. (Accurate to 2 decimal places.)



Determine the measure of the acute angle formed by the intersection of the asymptotes of the hyperbola $\frac{x^2}{36} - \frac{y^2}{16} = 1$. (accurate to 1 decimal place)

A. 47.9°
B. 56.3°
C. 66.7°
D. 67.4°

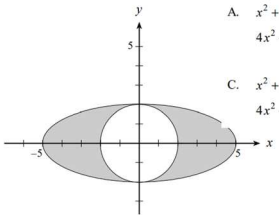
A sports stadium has a semi-elliptical dome for its roof. If its maximum height is 50 m and its span is 200 m, how high is the dome at a point 72 m from the centre? (Accurate to 1 decimal place.) **(3marks)**



Determine the distance between the vertices of the hyperbola $xy = 6$.

A. $2\sqrt{6}$
B. $4\sqrt{6}$
C. $2\sqrt{3}$
D. $4\sqrt{3}$

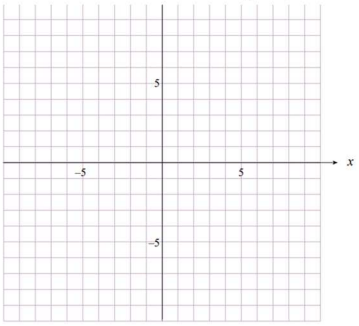
Which system describes the shaded region in the diagram below?



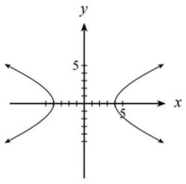
A. $x^2 + y^2 \le 4$, $4x^2 + 25y^2 \le 100$
B. $x^2 + y^2 \ge 4$, $4x^2 + 25y^2 \ge 100$
C. $x^2 + y^2 \le 4$, $4x^2 + 25y^2 \ge 100$
D. $x^2 + y^2 \ge 4$, $4x^2 + 25y^2 \le 100$

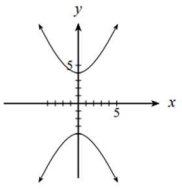
Graph the solution of the following system of inequalities on the grid provided.

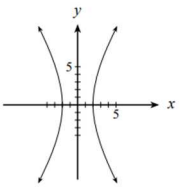
$$(x-2)^2 + (y+3)^2 > 25$$
$$x \le -(y+3)^2 + 4$$

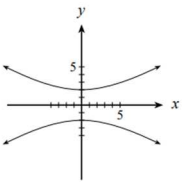


Which of the following graphs **best** represents $\frac{x^2}{16} - \frac{y^2}{4} = -1$?

A.


B.


C.


D.


Points ABCD are collinear with C as midpoint of AD, and B as midpoint of AC. Determine the coordinates of B if A has coordinates (–3, 7) and D has coordinates (3, –5).

A. (–1.5, 4)
B. (–1.5, 3)
C. (1.5, 1)
D. (1.5, 4)

Determine an equation for the set of all points which are 3 times as far from the point (0, 5) as they are from the point (–1, 2).

A. $3\sqrt{x^2 + (y+5)^2} = \sqrt{(x-1)^2 + (y+2)^2}$
B. $3\sqrt{x^2 + (y-5)^2} = \sqrt{(x+1)^2 + (y-2)^2}$
C. $\sqrt{x^2 + (y+5)^2} = 3\sqrt{(x-1)^2 + (y+2)^2}$
D. $\sqrt{x^2 + (y-5)^2} = 3\sqrt{(x+1)^2 + (y-2)^2}$

A bridge over a river is supported by a parabolic arch which is 100 m wide at its base. If the maximum height of the arch is 10 m, determine which equation could represent the arch.

A. $y = -0.2x^2$
B. $y = -0.1x^2$
C. $y = -0.001x^2$
D. $y = -0.004x^2$

The equation $Ax^2 + By^2 + Cy = 1$ represents an ellipse (not a circle). If $A > 0$ and $B > 0$, what conditions **must** be satisfied if this ellipse has its minor axis on the x-axis?

A. $C \ne 0$ and $A > B$
B. $C \ne 0$ and $A < B$
C. $C = 0$ and $A > B$
D. $C = 0$ and $A < B$

How many points of intersection are there for the following system?

$$x^2 + y^2 = 1$$
$$y = \sqrt{x}$$

A. 1
B. 2
C. 3
D. 4

At what point(s) will the graph of $x^2 - y^2 = 16$ intersect the graph of $x^2 + 4x + y^2 = 0$?

A. $(-4,\ 0)$
B. $(-4,\ 0),\ (4,\ 0)$
C. $(-4,\ 0),\ (4,\ 0),\ (2,\ 2\sqrt{3})$
D. $(-4,\ 0),\ (4,\ 0),\ (2,\ 2\sqrt{3}),\ (2,\ -2\sqrt{3})$

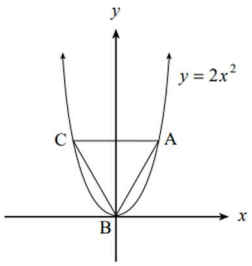
Points A, B, and C are on the parabola $y = 2x^2$ and ΔABC is equilateral. Determine the x-coordinate of point A.

A. $\frac{\sqrt{3}}{2}$

B. $\sqrt{3}$

C. 2

D. $2\sqrt{3}$



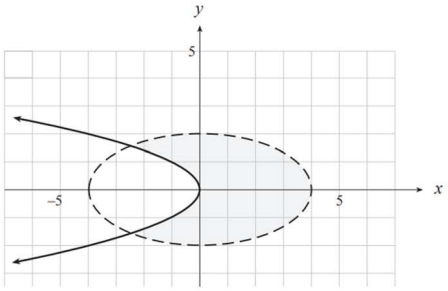
Determine all real ordered pairs that satisfy the following system:

$$y^2 - x^2 = 16$$

$$y = \frac{6}{x}$$

(Give answers that are exact **or** accurate to 2 decimal places.)

Which system describes the shaded region shown below?



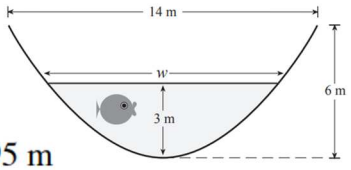
A. $\frac{x^2}{16} + \frac{y^2}{4} > 1$ and $x \geq -y^2$

B. $\frac{x^2}{16} + \frac{y^2}{4} < 1$ and $x \geq -y^2$

C. $\frac{x^2}{16} + \frac{y^2}{4} < 1$ and $x \leq -y^2$

D. $\frac{x^2}{16} + \frac{y^2}{4} > 1$ and $x \leq -y^2$

A canal has a cross section that is in the shape of a parabola. The width of the canal at the top is 14 m and the maximum depth of the canal is 6 m, as shown in the diagram. The depth of the water at its deepest point is 3 m. Determine the width, w, of the water surface.



A. 4.95 m

B. 7.86 m

C. 9.90 m

D. 10.41 m

Determine all values for k such that the following system will have exactly 2 different real solutions.

$$(x-2)^2 - \frac{(y+1)^2}{9} = 1$$

$$x = (y+1)^2 + k$$

A. $1 < k < 3$

B. $k < 1$ or $k > 3$

C. $-1 < k < 5$

D. $k < -1$ or $k > 5$

Determine the slopes of the asymptotes of $\frac{(x-1)^2}{4} - \frac{y^2}{16} = 1$.

A. $\pm\frac{1}{4}$

B. $\pm\frac{1}{2}$

C. ± 2

D. ± 4

. A hyperbola has vertices at $(1, -4)$ and $(1, 8)$. If the asymptotes have slopes ± 2, determine the equation of the hyperbola in standard form. **(3 marks)**

A pair of real numbers (a, b) with $a^2 + b^2 \leq \frac{1}{4}$ is chosen at random. If p is the probability that the curves with equations $y = ax^2 + 2bx - a$ and $y = x^2$ intersect, then $100p$ is closest to

(A) 65 **(B)** 69 **(C)** 53 **(D)** 57 **(E)** 61

Change $3y^2 + 6y - x - 3 = 0$ to standard form.

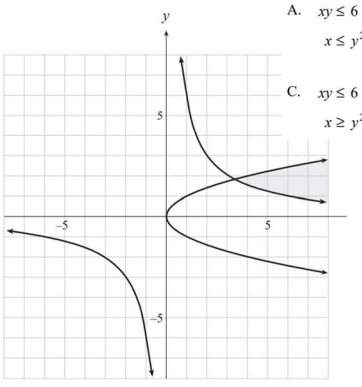
A. $x = 3(y-1)^2$

B. $x = 3(y+1)^2 - 4$

C. $x = 3(y+1)^2 - 6$

D. $x = 3(y+1)^2 - 9$

Which system of inequalities represents the shaded region?



A. $xy \leq 6$ and $x \leq y^2$

B. $xy \geq 6$ and $x \leq y^2$

C. $xy \leq 6$ and $x \geq y^2$

D. $xy \geq 6$ and $x \geq y^2$

Solve the following system algebraically. Express all solutions as ordered pairs. **(3 marks)**

$$x^2 + y^2 = 25$$
$$x = y^2 - 5$$

Suppose that on a parabola with vertex V and a focus F there exists a point A such that $AF = 20$ and $AV = 21$. What is the sum of all possible values of the length FV?

(A) 13 **(B)** $\frac{40}{3}$ **(C)** $\frac{41}{3}$ **(D)** 14 **(E)** $\frac{43}{3}$

Determine an equation for the ellipse that has vertices at (2, 2) and (–10, 2) and is tangent to the line $y = 5$.

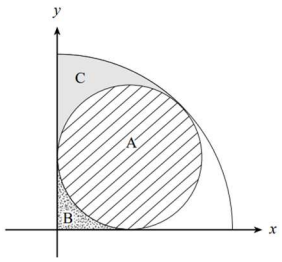
A. $\frac{(x+4)^2}{36} + (y-2)^2 = 1$

B. $\frac{(x+4)^2}{36} + \frac{(y-2)^2}{9} = 1$

C. $\frac{(x-2)^2}{9} + \frac{(y+4)^2}{36} = 1$

D. $(x-2)^2 + \frac{(y+4)^2}{36} = 1$

A circle is inscribed in the quadrant I sector of circle $x^2 + y^2 = 36$. If A and B represent the areas of the indicated regions, determine an expression for the area of region C.



A. $\frac{9\pi - A - B}{2}$ units^2

B. $9\pi - A - B$ units^2

C. $\frac{36\pi - A - B}{2}$ units^2

D. $36\pi - A - B$ units^2

A circle of radius r passes through both foci of, and exactly four points on, the ellipse with equation $x^2 + 16y^2 = 16$. The set of all possible values of r is an interval $[a, b)$. What is $a + b$?

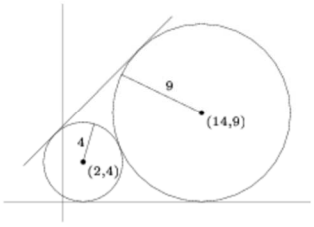
(A) $5\sqrt{2} + 4$ **(B)** $\sqrt{17} + 7$ **(C)** $6\sqrt{2} + 3$ **(D)** $\sqrt{15} + 8$ **(E)** 12

Problem

For how many integer values of k do the graphs of $x^2 + y^2 = k^2$ and $xy = k$ not intersect?

(A) 0 **(B)** 1 **(C)** 2 **(D)** 4 **(E)** 8

Circles with centers $(2, 4)$ and $(14, 9)$ have radii 4 and 9, respectively. The equation of a common external tangent to the circles can be written in the form $y = mx + b$ with $m > 0$. What is b?



(A) $\frac{908}{119}$ (B) $\frac{909}{119}$ (C) $\frac{130}{17}$ (D) $\frac{911}{119}$ (E) $\frac{912}{119}$

Rectangle $ABCD$ has area 2006. An ellipse with area 2006π passes through A and C and has foci at B and D. What is the perimeter of the rectangle? (The area of an ellipse is $ab\pi$ where $2a$ and $2b$ are the lengths of the axes.)

(A) $\frac{16\sqrt{2006}}{\pi}$ (B) $\frac{1003}{4}$ (C) $8\sqrt{1003}$ (D) $6\sqrt{2006}$ (E) $\frac{32\sqrt{1003}}{\pi}$

Let a, b, x, and y be real numbers with $a > 4$ and $b > 1$ such that

$$\frac{x^2}{a^2} + \frac{y^2}{a^2 - 16} = \frac{(x-20)^2}{b^2 - 1} + \frac{(y-11)^2}{b^2} = 1.$$

Find the least possible value of $a + b$.

The graph of $2x^2 + xy + 3y^2 - 11x - 20y + 40 = 0$ is an ellipse in the first quadrant of the xy-plane. Let a and b be the maximum and minimum values of $\frac{y}{x}$ over all points (x, y) on the ellipse. What is the value of $a + b$?

(A) 3 (B) $\sqrt{10}$ (C) $\frac{7}{2}$ (D) $\frac{9}{2}$ (E) $2\sqrt{14}$

The vertices of an equilateral triangle lie on the hyperbola $xy = 1$, and a vertex of this hyperbola is the centroid of the triangle. What is the square of the area of the triangle?

(A) 48 **(B)** 60 **(C)** 108 **(D)** 120 **(E)** 169